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THE USE OF OIL SPRAYS IN GRASSHOPPER CONTROL IN BRITISH COLUMBIA

BY E. R. BUCKELL

Dominion Entomologcial Laboratory, Kamloops, B. C.

The use of oil sprays has proved of value in grasshopper control operations on the open range lands of British Columbia under certain specific conditions.

Only when a species, such as *Camnula pellucida* (Scudder), which deposits its eggs in definite egg-beds which have been definitely located and staked during the previous summer, or when nymphs or adults are concentrated in very large numbers in small depressions or, as in the case of *Melanoplus mexicanus mexicanus* (Saussure), on tall weeds, and when weather conditions are not favourable for poisoning, is the use of oil sprays justified as an adjunct to the regular poisoned bait campaign. An important point in their favour is that they can be used in cool weather when poisoned baits would not be effective. Oil sprays kill by contact only and are valueless against the eggs in the soil. They have no lasting effect as have poisoned baits and are effective only on the grasshoppers actually hit by the oil emulsion at the time of spraying.

In the Nicola Valley in British Columbia there are large range areas which appear to have been ideal breeding grounds for the "range grasshopper", *Camnula pellucida* (Scudder), long before the white man came to Canada. Much of this area still provides suitable habitat for this species. In other sections of this area,, the grazing of cattle and the loosening of the surface soil by an enormous increase of pocket gophers has produced, in recent years, ideal conditions for the next most important range grasshopper, *Melanoplus mexicanus mexicanus* (Saussure), the lesser-migratory grasshopper, locally called the "red-legged" grasshopper.

The stockmen of the Nicola Valley formed a grasshopper control zone in 1931 and have since carried on an effective control campaign annually over this area of more than one million acres. In the course of the work during recent years, the main breeding grounds of the grasshoppers became well known to those in charge of the control crews in the field, and as a practice, the egg-beds were located and marked in the autumn, and the young nymphs hatching from these egg beds were poisoned in the spring.

Mr. Charles Guichon, Field Supervisor for the Nicola Valley Control Zone, noticed that in dull weather immense numbers of small *Camnula* nymphs failed to feed readily, escaped poisoning, and spreading out from the egg-beds, thus adding to the difficulty of control.

To meet this situation Mr. Guichon began to experiment with oil sprays on the small nymphs on the egg-beds in 1935, using a small hand pump with gasoline and coal oil. In 1936, a larger hand pump was used with Diesel oil at full strength. The oil killed everything it touched, and the hoppers from one egg-bed of several acres were killed by this method. In 1938, after discussing the whole question with officers of the Kamloops Laboratory of the Division of Entomology then engaged in grasshopper research, the Nicola Valley Grasshopper Control Zone purchased an orchard spray machine of 150 gallon capacity and sprayed with ten per cent oil emulsion. In 1939, a second sprayer with a 300 gallon tank was purchased, and the use of these two machines made possible

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a most excellent control of *Camnula* nymphs under weather conditions which would most assuredly have allowed them to escape destruction if poisoned bait only had been used.

During the 1939 campaign, Diesel fuel oil at a cost of 13.9 cents per gallon was used as a spray at the rate of 7 to 10 Imperial gallons to 150 gallons, U. S., of water for *Camnula* nymphs and up to 15 gallons of oil to 150 gallons, U. S., of water for use against *M. mexicanus mexicanus* (Saussure) which appeared to require a stronger oil content. The oil was emulsified with a commercial casein spreader, using 2 pounds to 150 gallons. In preparing the material, the oil was placed in the tank first, and the emulsifier which had been creamed in a little water was added, after which the tank was filled with water with the agitator running. The spray machines were regular orchard sprayers mounted on motor trucks. Each sprayer was equipped with 50 foot lengths of hose and with spray guns fitted with No. 5 disc nozzles.

The spring of 1939 was dull and wet and a long hatching period occurred. One particularly difficult egg-bed required to be oiled six times. Before oiling, the ground was alive with tiny nymphs; a week later only an occasional larger nymph which had escaped the oil could be seen amidst another hatch of tiny nymphs. As many as 2,400 gallons of Diesel oil emulsion spray was put on this bed alone in one day, at the rate of 100 gallons to an acre. There is no doubt that in 1939 the complete control of what might have been a disastrous outbreak was accomplished over 200,000 acres of cattle range by control crews using poisoned bait over the main range area and the oil spray on the egg-beds. The use of oil virtually exterminated all nymphs hatching on some 44 egg-beds with a *combined* area of *approximately* 80 acres.

The use of oil emulsion sprays in this way is still recognized as being in the experimental stage. Effective spraying machinery is expensive and the oil emulsion costly. However, the cost of the control campaign in the protection of the 1,000,000 acres of cattle range of the Nicola area was less than one cent per acre. Further work is needed to determine the best type of oil to use, the minimum effective strength and the best type of nozzle.

It is believed that the judicious use of oil sprays will greatly assist grasshopper control under certain conditions which prevail on the range lands of British Columbia. It must be recognized that this form of control can only assist and can never replace the use of poisoned baits, and this point must be clearly kept in mind when contemplating the use of oil sprays. Furthermore, the advice of a trained entomologist should be obtained before attempting to use oils, as only with species that concentrate their eggs in restricted areas such as *Camnula pellucida* (Scudder), or species whose nymphs and adults congregate in patches of weeds, such as *Melanoplus mexicanus mexicanus* (Saussure), is the use of this method of control justified.

NEW NEARCTIC CRANE-FLIES (TIPULIDAE, DIPTERA). PART XIV.

BY CHARLES P. ALEXANDER
Massachusetts State College, Amherst, Massachusetts

The preceding part under this general title was published in 1929 (Can. Ent., 61: 15–22). The novelties discussed at this time were included in collections sent to me by my friends, Professor J. Speed Rogers, of the University of Florida, and by Dr. Henry K. Townes, of Cornell University. Except where indicated to the contrary, the types of the new forms are in the collection of Professor Rogers, to be placed eventually in the Museum of Zoology of the University of Michigan. I wish to express my deep thanks to the collectors for the privilege of describing these species.

Tipula (Yamatotipula) succincta n. sp.

Allied to *iroquois;* general coloration light gray, the praescutum with four darker gray stripes that are narrowly bordered by darker; antennal flagellum black; wings with a strong brownish tinge, the cells beyond cord somewhat darker; a narrow dark seam on cord; abdominal tergites brown, the posterior borders of the segments narrowly obscure yellow; male hypopygium with the caudal border of tergite produced into two low submedian lobes that are set with strong black setae; outer dististyle relatively short and broad; inner dististyle on face with a long slender blackened arm; gonapophyses terminating in broadly flattened spatulate blades.

Male.—Length about 11.5–12 mm.; wing 12.5–13 mm.; antenna about 5 mm.

Frontal prolongation of head brownish gray; nasus distinct; palpi dark brown. Antennae with scape and pedicel brownish yellow, flagellum black; flagellar segments only moderately incised. Head brownish gray, clearer gray on the front and anterior vertex; vertical tubercle low.

Pronotum gray, restrictedly darkened medially. Mesonotal praescutum light gray with four darker gray stripes that are narrowly bordered by darker, the mesal edges of the intermediate stripes forming a broad median dark vitta, most distinct on the cephalic third; darkened borders of lateral stripes less evidently indicated; posterior sclerites of notum gray, the scutal lobes with two confluent dark areas; a very poorly indicated central darkening on mediotergite. Pleura light gray, variegated with darker gray on the ventral sternopleurite and meron, and on most of the anepisternum and adjoining portions of the pteropleurite; dorsopleural membrane buffy. Halteres pale reddish brown. Legs with the coxae light gray; trochanters obscure yellow; femora obscure yellow, the tips rather narrowly dark brown; tibiae light brown, the tips darker; tarsi black. Wings with a strong brown tinge, the cells beyond cord somewhat darker but not forming a clearly defined dark wing tip; cells *C* and *Sc* darker brown than remainder of ground; stigma brown; narrow dark seams on anterior cord and even more narrowly on posterior cord; posterior border of wing very narrowly bordered by darker; veins brown. Venation: *Rs* nearly straight, about twice *m-cu;* petiole of cell M_1 considerably longer than *m;* M_3+_4 from one-half to three-fifths the length of basal section of M_3.

Abdominal tergites brown, the posterior borders of tergites narrowly obscure yellow; sternites yellow; hypopygium darkened. Male hypopygium with the caudal margin of tergite produced into two submedian lobes that are separated by a small but deep U-shaped median notch, the lobes low, densely provided with strong black setae. Outer dististyle relatively short and broad, widest near base, the tip obtuse. Inner dististyle with posterior angle produced into a short black spinous point; face of style below beak with a long slender blackened arm that is nearly as long as the beak itself, weakly dilated at tip. Gonapophyses appearing as flattened spatulate blades, the expanded portions long-oval, subequal in length to the stems. A depressed flattened, pale, median lobe at ex-

treme base of ninth sternite just caudad of margin of eighth sternite, with a still smaller median lobule more distad, at base of sternal incision. Paired setiferous cushions on the ninth sternite, such as are found in *iroquois*, are lacking.

Habitat.—Indiana.

Holotype, ♂, Hanover, Jefferson Co., April 14, 1931 (J. S. Rogers); Collector's No. 139. *Paratopotype*, ♂.

The nearest allies among the described species in eastern North America are *Tipula* (*Yamatotipula*) *brevifurcata* Alexander, of the southern Appalachians, and *T.* (*Y.*) *iroquois* Alexander, more widely distributed in mountainous eastern North America. The species are easily distinguished among themselves by the structure of the male hypopygium.

Tipula (Tipula) nebulinervis n. sp.

Belongs to the *ultima* group, allied to *tennessa;* general coloration of thorax gray, the praescutum with four more reddish brown stripes that are narrowly bordered by darker; antennae short, the basal segments yellow; wings with the ground color grayish subhyaline, the veins broadly and conspicuously bordered by reddish brown to produce a streaked appearance; abdomen obscure yellow, the tergites with a poorly defined, more brownish, median stripe; male hypopygium with basistyles at mesal edge each with a longe, pale, pendulous lobe.

Male.—Length about 16–17 mm.; wing 18.5 mm.; antenna about 3.5 mm.

Frontal prolongation of head yellow, relatively long; palpi obscure yellow, the short terminal segment a little darker.. Antennae short, yellow, the outer flagellar segments weakly bicolored; basal enlargement of segments moderately developed; longest verticils a little exceeding the segments. Head brownish gray; vertical tubercle simple, extended in front into a small tubercle.

Pronotum brownish gray, more yellow on sides. Mesonotal praescutum with the color gray, with four more reddish brown stripes that are narrowly and indistinctly bordered by slightly darker brown, especially distinct on the intermediate stripes; scutal lobes reddish brown, the median area more pruinose; posterior sclerites of notum dark gray. Pleura gray, the dorsopleural membrane yellow. Halteres elongate, stem yellow, knob slightly darkened. Legs with coxae light gray; trochanters yellow; femora obscure yellow basally, passing into brown; tibiae and tarsi brown. Wings with the ground grayish subhyaline, the veins broadly and conspicuously margined with more reddish brown, restricting the ground to the centers of the cells and producing a streaked appearance; costal border of wing to wing tip narrowly darker brown, including cell *C*, stigma and cell R_2; cell *Sc* more yellowish brown; veins reddish brown. Venation: R_1+_2 preserved; cell R_2 narrowed at base; petiole of cell M_1 subequal to *m*.

Abdomen, including hypopygium, obscure yellow, the tergites with a poorly defined, more infuscated, median stripe. Male hypopygium with the median emargination of tergite very broad and shallow, the low lobes sinuously and obliquely truncated with only their lateral portions restrictedly blackened. Outer dististyle unusually short and broad, the greatest width of the blade approximately two-thirds the length. Inner dististyle with a conspicuous basal flange or flattened plate, the anterior angle produced into a black spine, the posterior angle into a truncated lobe. Mesal face of basistyle opposite the point of insertion of dististyle produced into a very long, pendulous lobe that bears several unusually long setae at apex.

Habitat.—Florida.

Holotype, ♂, Jackson Co., November 15, 1931 (J. S. Rogers); Collector's No. 12. *Paratopotypes*, 2 ♂ ♂.

Tipula (*Tipula*) *nebulinervis* is most closely allied to *T.* (*T.*) *tennessa* Alexander, differing conspicuously in the peculiar pattern of the wings, and in the structure of the male hypopygium. Superficially, especially in the pattern of the wings, it resembles *Tipula* (*Yamatotipula*) *manahatta* Alexander, of eastern North America.

Tipula (Lunatipula) mariannae n. sp.

General coloration brownish yellow; antennae (male) long, approximately one-half the length of body, the flagellar segments bicolored, with brownish black bases: wings with a strong brownish yellow suffusion, the costal border and stigma still darker; obliterative area before stigma restricted but conspicuous, ending posteriorly in cell 1*st* M_2; no post-stigmal brightening; abdominal tergites obscure yellow, more or less darkened medially, especially the outer segments; male hypopygium with the tergite broadly emarginate medially, produced into two short lateral lobes, the base of the emargination with a small U-shaped notch; eighth sternite simple, the median area with a sparse group of setae but with no lobes or hair-pencils.

Male.—Length about 14 mm.; wing 15.5 mm.; antenna about 7 mm.

Frontal prolongation of head obscure yellow; nasus stout; palpi obscure yellow, the terminal segment darker at tip. Antennae (male) elongate, approximately one-half the length of body; basal three segments yellow; succeeding segments bicolored, the basal enlargement brownish black, the remainder yellow; on outer three or four segments more uniformly darkened; basal enlargements of segments relatively small, the verticils much shorter than the segments. Head light brown, more yellowish in front; a capillary, darker brown, median vitta; vertical tubercle small and simple.

Thorax of unique type somewhat discolored, general coloration apparently medium brown or yellowish brown, with indications of four darker stripes; scutellum and mediotergite more yellowish, the former with a slight central darkening. Pleura obscure yellow. Halteres with stem obscure yellow, knob darkened basally, pale at apex. Legs with coxae and trochanters yellow; femora obscure yellow, clearer basally, somewhat darker on apical portion; tibiae obscure brownish yellow; tarsi passing into black; claws simple. Wings with a strong brownish yellow suffusion; cells *C* and *Sc*, together with the stigma, still darker brown; prearcular field clearer yellow; a restricted obliterative streak before stigma, extending from before stigma along anterior cord into base of cell 1*st* M_2; no post-stigmal brightening; veins yellowish brown. Venation: *Rs* about one-half longer than *m-cu;* extreme tip of R_1+_2 atrophied; cell 1*st* M_2 long, widest across base; petiole of cell M_1 long, approximately three times *m*, cell M_4 deep, M_3+_4 shorter than or subequal to basal section of M_1+_2.

Abdominal tergites obscure yellow, with a median dark stripe, on the outer segments this becoming broader and more distinct, on the third and succeeding segments including the posterior tergal borders; subterminal segments more extensively darkened; basal sternites obscure yellow, outer segments more darkened; hypopygium chiefly pale.. Male hypopygium with the caudal margin of tergite broadly emarginate, produced into short lateral lobes, medially with a small U-shaped notch. Ventro-mesal region of basistyle produced into low, broad, darkened lobes that are set with long white setae; suture of basistyle extensive, obliterated dorsally. Outer dististyle small, the outer blade narrow. Inner dististyle with the beak very broad and obtuse, more or less blackened; a strong triangular black tooth below the beak; outer lobe of style large and conspicuous. Eighth sternite simple, the caudal margin transverse, with a sparse group of moderately long setae on the median area but without lobes or hair-pencils.

Habitat.—Florida.

Holotype, ♂, Marianna, Jackson Co., April 13, 1928 (J. S. Rogers); Collector's No. 2.

Tipula (*Lunatipula*) *mariannae* is quite distinct from all members of the subgenus in the southeastern United States. It seems closest to *T.* (*L.*) *disjuncta* Walker, differing conspicuously in the coloration and structure of the antennae, and in the structure of the male hypopygium.

Dicranota (Plectromyia) townesi n. sp.

Size large (wing, male, over 6 mm.); general coloration grayish brown, the praescutum with three conspicuous dark brown stripes; antennae 13-segmented, black throughout; legs brownish black; wings with a weak brown tinge, the costal border and stigma a trifle darkened; venation of radial field variable, with cell R_3 ranging from short-petiolate to sessile; abdomen brown, the tergites darker; male hypopygium with the tergite very strongly produced medially, the lateral arms obtusely rounded at tips; interbases bidentate at tips.

Male.—Length about 5.8–6 mm.; wing 6.2–6.5 mm.

Rostrum and palpi black. Antennae short, 13-segmented, black throughout; basal flagellar segment elongate, narrowed basally; succeeding two or three segments nearly globular; outer segments passing into oval. Head dark.

Pronotum brown. Mesonotal praescutum grayish brown, with three conspicuous, dark brown stripes, the median one broad; centers of scutal lobes darkened; posterior sclerites of notum chiefly dark brown. Pleura light brown, the ventral sternopleurite darker. Halteres with stem pale, knob darkened. Legs with coxae and trochanters pale brown; remainder of legs brownish black. Wings with a weak brownish tinge, the costal border and stigma a trifle darker; veins brown. Venation: Cell R_3 broadly sessile (R_4+_5 present) to short-petiolate ($R_2+_3+_4$ present), this condition unusually variable for a single species; cell M_3 longer than its petiole. In one wing of the paratype, there is a faint adventitious crossvein in cell R_1, as in *Dicranota*.

Abdomen brown, the tergites somewhat darker; hypopygium dark. Male hypopygium with the median area of tergite strongly produced into an obtusely rounded lobe, much more conspicuously so than in *confusa* or *modesta*, but less so than in *petiolata*; lateral tergal arms appearing as flattened blades, their apices obtusely rounded. Interbases bidentate at tips, the teeth slightly unequal. Aedeagus in part strongly blackened.

Habitat.—South Carolina.

Holotype, ♂, Greenville Co., April 9, 1932 (H. K. Townes). *Paratopotype*, ♂; *paratype*, 1 ♂, on microscope slide, Greenville Co., altitude 2,400 feet; Rogers Collection, No. 1295. Type in my collection, through generosity of Dr. Townes.

I take great pleasure in naming this interesting species in honor of the collector, Dr. Henry K. Townes, who has secured many rare and interesting crane-flies in North and South Carolina. The very strongly produced median area of the tergite, with simple, obtusely rounded tergal arms, readily separates this fly from the other regional species of the subgenus that have the median lobe of the tergite obtusely rounded, including *Dicranota* (*Plectromyia*) *confusa* Alexander and *D.* (*P.*) *modesta* (Osten Sacken). The paratype has the median tergal lobe even more strongly produced than in the holotype, and in the slide mount of the hypopygium the apices of the lateral tergal arms appear somewhat more angulate, this appearance perhaps due to the method of mounting. Superficially, the hypopygium is much like that of *Dicranota* (*Rhaphidolabis*) *cayuga* (Alexander) but the dististyle is different and the tergite much more strongly produced medially.

Erioptera (Erioptera) leptostyla n. sp.

Male.—Length about 5.5 mm.; wing 5 mm.

Described from the unique type, cleared and mounted on a microscope

slide. General coloration evidently pale green, as in the *chlorophylla* group. Eyes of male very large, contiguous on dorsal surface of head. Halteres and legs pale. Wings uniformly pale, including the veins which are ill-delimited against the ground. Male hypopygium with the outer dististlye a simple slender rod that is almost straight and of virtually the same diameter throughout its length, the tip being subequal in diameter or even a little dilated, obtusely rounded. Inner dististyle fused basally with the outer, appearing as a strong simple rod, shorter than the outer style, strongly curved in a semicircle, the acute darkened tip directed cephalad; surface of style with microscopic setigerous punctures but otherwise unarmed. Gonapophyses appearing as strong curved chitinized hooks, their margins smooth.

Habitat.—Michigan.

Holotype, ♂, on a microscope slide, Washtenaw Co., August 23, 1921 (J. S. Rogers); Collector's No. 226.

Among the described species of the *chlorophylla* group, the present fly is closest to *Erioptera* (*Erioptera*) *chlorophylloides* Alexander and *E.* (*E.*) *gaspeana* Alexander, agreeing in the simple dististyles and uniformly smooth blackened horns of the gonapophyses. It differs very evidently in all details of structure of the male hypopygium.

Erioptera (Erioptera) chlorophylloides orthomera n. subsp.

Characters as in typical *chlorophylloides* Alexander, differing in the structure of the male hypopygium, especially of the gonapophyses. The latter appear as slightly flattened, nearly straight blades, the tips acutely pointed and narrowly blackened. In typical *chlorophylloides*, the apophyses appear as slender, curved horns, broad at base, thence gradually narrowed to the long slender spinous points, with nearly the distal half of the entire structure blackened.

Habitat.—Connecticut.

Holotype, ♂, State Line Pond, Stafford Springs, altitude 910 feet, June 14, 1933 (C. P. Alexander); author's collection.

The present insect was found associated with the typical form in a boggy woods.

Molophilus (Molophilus) sparus n. sp.

Male.—Wing 4 mm.

Known to me only from the type slide on which the wings and male genitalia are preserved. Wings with a brownish tinge, the basal portions a little brightened; veins and macrotrichia brown. Venation: R_2 and *r-m* in transverse alignment; petiole of cell M_3 nearly twice *m-cu;* vein *2nd A* strongly sinuous, ending beyond level of posterior end of *m-cu.* Male hypopygium with the beak of basistyle a straight black spine. Outer dististyle with arms long, the outer only moderately expanded. Basal dististyle a moderately long, simple rod, gently sinuous, narrowed gradually to the long acute point; on outer face of distal third with several appressed teeth; no basal spine as in *novacaesariensis.* Phallosomic plate broad, the apex very obtuse to truncate.

The nearest relative is *Molophilus* (*Molophilus*) *novacaesariensis* Alexander, which was taken on the same day and at the same place as the present fly. From the structure of the male hypopygia, I would consider the two flies to be distinct without question. In *novacaesariensis*, the basal dististyle is a much longer, more slender rod, nearly straight, with very sparse and small, nearly apical denticles; in addition, there is a single, larger, nearly erect spine just beyond base of style, in cases this latter bifurcated at tip, in others simple; phallosomic plate much narrower, the tip obtuse.

Habitat.—Florida.

Holotype, ♂, microscope slide, Alachua Co., March 8, 1925, (J. S. Rogers); Collector's No. 164.

BAETISCA ROGERSI, A NEW MAYFLY FROM NORTHERN FLORIDA*

BY LEWIS BERNER,
Gainesville, Florida

The remarkable nymphs of *Baetisca rogersi* were first found in the streams of northwest Florida in April, 1938. Several other nymphs were collected in June and one in November, but it was not until March of the following year that I was successful in securing adults. The nymphs are very hardy; those collected March 17 withstood an automobile trip of nearly three hundred miles and confinement in a small jar for almost three days with only a few casualties. In the laboratory at Gainesville, one male and two female imagoes were reared from the survivors.

The nymphs of *B. rogersi* usually inhabit the gravel beds in sand-bottom creeks. Dr. Traver's description of the habits of *B thompsonae*† indicates that the immatures of the two species occupy similar habitats. The great development of the lateral spines in the nymphs of these two species is probably correlated with the ability to maintain themselves in moderately to swiftly flowing water. The *Baetisca* nymphs, with their short, rotund bodies, would certainly find it rather difficult to retain their position in the gravel, even though using their claws for clinging to the substratum without these long projections to act as balancers. Nymphs of *Baetisca* are not the only mayflies living in these riffles, but the other forms present are streamlined, clinging types; in shape, either flattened (*Stenonema*) or rounded and slender (*Baetis*).

The characteristic spines and tubercles are relatively more conspicuous in the younger nymphs, but in the last instar they become somewhat obscured by the formation of the adult structures. In general, however, the position and degree of projection of these spines remains quite constant throughout the nymphal period and varies little from one individual to another. *Baetisca rogersi* nymphs are unique among described forms in having serrations and double projections along the lateral borders of the mesonotum and in the presence of prominent abdominal processes.

On abdominal segment six, the last pair of gills lie in a depression on the anterior face of the mediodorsal prominence. These gills, in the living animal, fit together in such a way that they form a tube which is rhythmically exposed and covered by the mesonotal shield. The duct probably acts as a water guide, leading a current under the mesonotum to the well-tracheated, anterior gills.

The holotype emerged in the laboratory about 3:00 P. M.; March 29; it molted between 9:30 and 10:00 A. M., March 30, after an interval of about eighteen and one-half hours. The allotype emerged at 2:45 P. M., March 31, and underwent its subimaginal molt at 8:45 A. M., April 1.

Baetisca rogersi n. sp‡

Diagnosis: Male with basal third of fore wing and basal three-fourths of hind wing reddish-brown; outer margin of fore wing strongly scalloped; legs greenish-yellow; genitalia of the *carolina* type§. Female similar to male.

Nymph with prominent frontal projections; genae not produced into spines; mesonotum covered with prominent tubercles; dorsal spines much reduced; lateral spines prominent; smaller lateral projections of mesonotum anterior to large spines; lateral margins of mesonotum crenulate to serrate; abdominal tergites 7-9 with strongly elevated, median processes.

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*Contribution from the Department of Biology, University of Florida.

†Traver, J. R. 1937. Notes on mayflies of the southeastern states (Ephemeroptera). J. Elisha Mitchell Sci. Soc. 53: 61-65, pl. 6.

‡I take pleasure in naming this species for Professor J. Speed Rogers of the Department of Biology, University of Florida, whose aid and advice has been invaluable.

§Needham, J. G., Traver, J. R., and Hsu, Y. 1935. The biology of mayflies. Pp. 556-562, text fig. 148. Comstock Publishing Co., Ithaca.

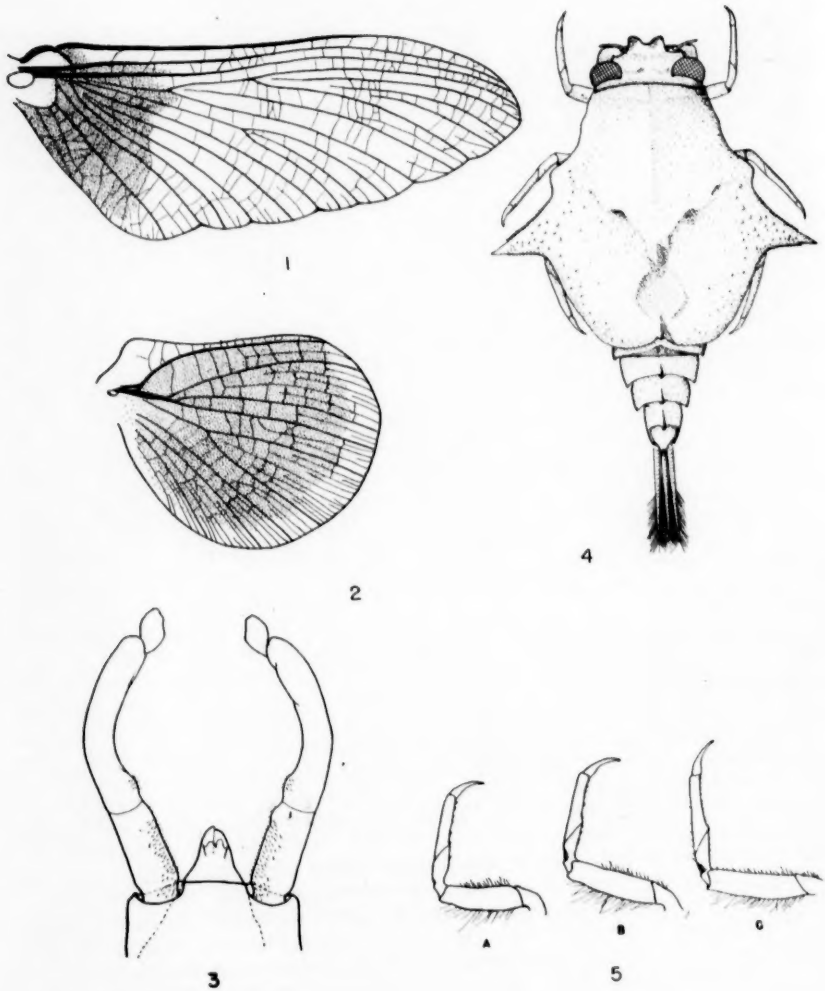
Relationships: *Baetisca rogersi*, from the standpoint both of nymph and adult, seems to be most closely related to *B. carolina* and *B. thompsonae*. The male genitalia and the coloration of the wings in the adult, the absence of dorsal spines on the mesonotum and similarity of mouthparts in the nymphs, all show that of the described Baetiscine species, *rogersi* is most closely related to these two.

Description of Holotypic male Imago (in alchol): Length of body—7.8 mm.; caudal filaments—5.9 mm., fore wing—9.5 mm.

Head: Eyes grayish-yellow; separated only by the width of epicranial suture; distinctly oval in outline with the long axis extending laterad and slightly caudad. Vertex grayish-brown, becoming orange near base of ocelli. Frons grayish-brown. Antennal socket with reddish tinge. Basal antennal segments tinged with brown, flagellum pale. Ocelli yellowish-white. *Thorax*: Pronotum almost entirely concealed by eyes; grayish-brown. Mesonotum grayish-brown, covered with fine black penciling; margins of scutellum brown, median area pale. Metanotum grayish-brown. Prosternum brown; projection darker brown, extending well beyond fore coxae. Meso- and metasterna grayish-brown with black pencilings. Pleura grayish-brown. *Legs*: Pale greenish-yellow. Fore leg slightly shorter than body. Each tarsal joint with narrow, light-brown ring. Under sides of tips of paired fore claws brown; on other legs, blunt claw, only, brown on under side. Measurements of legs: forefemur 2.1 mm., tibia 1.5 mm., tarsus 3.3 mm.; mid-femur 1.3 mm., tibia .65 mm., tarsus 1.2 mm.; hind-femur 1.3 mm., tibia .75 mm., tarsus 1.2 mm. *Wings*: Longitudinal veins amber. Outer margin of fore wing prominently scalloped; thickened. Basal third of fore wing reddish-brown. Costal angle of hind wing slightly obtuse. Reddish-brown area extending over basal three-fourths of metathoracic wing; outer fourth and costal border in angular portion clear. (Figs. 1 and 2). *Abdomen*: Dorsum light reddish-brown. Posterior margins of tergites 2-8, where they overlap the following segments, reddish-brown. Prominent median brown line on 7—10, fainter on 6. Tubercle on posterior half of tergite 6 prominent, strongly marked with black penciling; transverse black line across tubercle extending laterally about half way across the tergite. Tergites 2—6 predominantly darker than posterior ones; 6 with large, pale, triangular region covering mid area anterior to tubercle; base of triangle along anterior border. Lateral borders of 3—5 and anterior corners of 6 dark. At anterior border of 7—9, a prominent black band extending across tergite, becoming weak in region of mid-dorsal line; these segments light brown laterally. Whitish granulations scattered over segments 7—10. Weak, black reticulation on tergites 6—9; most prominent on 6. Postero-lateral spines very weak on 8, prominent on 9. Prominent spiracular openings indicating positions of nymphal gills on tergites 2—6; these openings pale and closest together on 6, progressively farther apart on anterior segments; a ridge extends laterad and obliquely caudad from these scars on segments 2—5. Sternites yellowish-white, no distinctive markings. *Genitalia*: Yellowish white; similar to those of *B. carolina* and *B. thompsonae*. (Fig. 3). *Caudal filaments*: Slightly darker than genitalia, and with a more brownish tinge. Light brown annulations at joints in proximal two-thirds. Stub of median filament reddish-brown; this coloration continuous with red-brown mid-dorsal line, consequently extending this line well beyond abdomen; stub pale ventrally.

Description of Allotypic Female Imago (in alcohol): Length of body—7.8 mm.; caudal filaments—5.3 mm.; fore wing—9.5 mm. *Head*: Large, black markings in median area of vertex; posterior border of head black. Remainder of head pale but covered with a network of fine black lines which, in places, almost conceals pale base color. Bases of ocelli dark but distally becoming reddish-brown. Basal antennal segments brownish, flagellum paler. Compound eyes grayish-yellow. *Thorax*: Color pattern as in male. Processes of prosternal

PLATE X.



Baetisca rogersi n. sp.
Fig. 1. Fore wing of female imago.
Fig. 2. Hind wing of female imago (not drawn to same scale as fore wing).
Fig. 3. Male genitalia.
Fig. 4. Mature female nymph.
Fig. 5. Legs of nymph. A. 1st right leg; B. 2nd right leg; C. 3rd right leg.

projection more widely separated and shorter than in male. *Wings*: As in male. *Legs*: Femur of fore leg distinctly greenish-yellow; remainder of leg light brown, except for brown tarsal joinings. Middle and hind legs greenish yellow, tarsal joinings light brown. Blunt claws on all legs brown. *Abdomen*: Dorsum purplish-brown, marked with black; otherwise much as in male except that brown posterior borders much less extensive and pale area on tergite 6 less pronounced. Ventrally yellowish-white; covered with black reticulation. *Caudal filaments*: Tinged with reddish-brown proximally, pale in outer fourth; tinted portions annulate with brown.

Description of Nymph (in alcohol): Fig. 4. Length of body—7.5-10 mm.; greatest width of mesonotum—6.5-7.7 mm.; length of mesonotum—5-6.7 mm.; caudal filaments—2-2.2 mm. *Head*: Frontal process prominent; projections rounded; dorsally extending forward from head at approximately ninety degree angle with head. Genae moderately produced, corners rounded; lateral production of genae weakly crenulate. On female nymphs and young male nymphs, a pair of submedian, more or less rounded elevations between eyes. Head covered with blackish-brown tubercles; absent from frontal projection. Prominent black spot just ventral to compound eye and near lateral margin of head. Sharp ridges around upper side of antennal socket. Frons swollen below its projection; swelling ending in ridge on same level with genal projections. Nine antennal segments; basal antennal segments brownish; antennal socket ringed with brown. Mouth parts similar to those of *B. carolina;* brown spots scattered over labial palps, also a few on labrum. Ocelli inconspicuous; marked by absence of tubercles. *Thorax*: Width of mesothorax from tip of lateral spine to tip of opposite spine varying from 1—1½ mm. greater than length from anterior edge of mesonotum to posterior margin of wing pads. Lateral margins of mesonotum crenulate to serrate; serrations strongest along margins of lateral spines and becoming less prominent away from these spines. Lateral spines long, sharp pointed, brown at tip; anterior to these spines, another pair of lateral thoracic extensions but these not sharp tipped, much less prominent, and somewhat obtuse. Anterolateral corners notched to receive head. Dorsal spines reduced to mere rounded elevations. Median carina most prominent on level with lateral spines; at posterior level of spines, carina elevated into a prominent hump; at posterior margin, again elevated into a prominent hump. These four elevations, to some extent, run together and enclose a median depressed area. In young specimens, anterior third of median carina of mesonotum raised into sharp elevation. At middle elevation of median carina, a pair of prominent ridges arise and run antero-laterally along the base of the wing pads. Near anterior margin of mesothorax, a prominent transverse ridge passing from one corner to the other; from each side, the chitin slopes away at a rather sharp angle. Entire mesothorax covered with prominent blackish tubercles; these quite large at the bases of the lateral spines, smaller dorsally and becoming sparser on wing pads. Anterior, transverse ridge formed of a line of these smaller tubercles set close together. Posterior elevation of median carina truncated and excavated to receive projection of segment 6. Posterior margin of wing pads fringed with long hairs. Sternum covered with small setae; in well-marked specimens, base of seta quite prominent and bearing a strong resemblance to the dorsal tubercles. Prosternum concave; indentation on lateral border, in posterior fourth, to receive median coxal spur. This indentation is a groove which locks fore coxa into place and in which spur moves dorso-ventrally. *Legs*: Hairy; bases of hairs prominent, giving, in dark specimens, a freckled appearance to the femora, coxae and throchantera. A large blackish-brown, outer, proximal area on tibia; broad, light-brown, median band on tarsus. (Figs. 5a, b, c). *Abdomen*: Segments 1-5 completely concealed; beneath gills, these segments quite pale. Tergites 7-10 yellowish-brown. Pyramidal structure on segment 6 very strong; posterior face

almost vertical and subequal to or longer than the greatest length of tergite 7; lateral and anterior face distinctly concave while posterior side more flattened; gills of segment 6 fit exactly into anterior concavity and act as a water guide; lateral borders of anterior face, in profile, sinuate; lateral concavities blackish-brown in well marked specimens except for pale streak at the bottom of concavity, in more poorly marked specimens, the blackish-brown less extensive to obsolescent. Postero-lateral portions of remainder of tergite 6 usual brown color, while remainder of lateral concavities, the portion into which the wing pads fit, are pale (the blackish-brown parts exposed). Prominent tubercles covering posterior face of raised portion of tergite 6. Tergites 7-10 covered with hairs; bases of these hairs superficially appearing tuberculate but much less prominent than tubercles on 6. A continuous blackish-brown, median line on tergites 7-10, may be interrupted posteriorly on 7–9, appears continuous with middle tail (this tail reddish-brown, at least basally). At anterior margins of 7–10, a pair of broad, brownish-black, transverse lines extending inward from lateral borders almost to median line. Tergites 7–10 pale yellowish-brown; 10 with a pair of light-reddish, submedian patches near posterior margin. Prominent elevations arising from the mid-posterior half of tergites 7–9. These elevations approximately equal in height to half the length of their respective tergites; erect on segments 7 and 8, while on 9 elevation bent caudad. Elevations keeled; these elevations, in poorly marked specimens, interrupt the mid-dorsal line. Lateral borders of segments 6–9 weakly crenulate; crenulations weakest on 6. Postero lateral angles of 5–9 produced; 10 in median area produced posteriorly into a pair of submedian spinous prolongations. Entire under-surface of abdomen covered with setae; the bases of setae prominent giving a freckled aspect to the abdomen. An inconspicuous pale spot near lateral borders of sternites 2–6. At anterior borders of sternites 7–9, a pair of large brownish-black spots placed about midway between median line and lateral margin. Gills completely concealed by mesonotum. Gills on tergite 2 form a protective covering for all others except those on segment 6.

Caudal filaments: All three filaments equal in length; heavily fringed with long hairs. Pale except for light-brownish tinge at base of laterals; proximal third of median tail reddish-brown. In distal half, tails with faintly annulate appearance; these annulations becoming distinct in region where outer hairs increase in prominence.

Holotype—Male imago, in alcohol. Reared from nymph. Sand-bottom creek, 4½ miles south of River Junction, Gadsden Co., Florida, March 17, 1939 In collection of Museum of Comparative Zoology.

Allotype—Female imago, In alcohol. Reared from nymph. Same data as for male. In collection of Museum of Comparative Zoology.

Paratypes—One female imago, in alcohol. Reared from nymph. Same data as for male. In author's collection.

Five nymphs in collection of Museum of Comparative Zoology. Same data as for male imago.

Locality records: (from nymphs) Freeport, Walton Co., April 2, 1938 (H. H. Hobbs and L. J. Marchand); Milton, Santa Rosa Co., April 4, 1938 (H. H. H. and L. J. M.); Niceville, Okaloosa Co., June 7 and Nov. 6, 1938 (L. Berner); 4½ miles south of River Junction, Gadsden Co., March 17, 1939 (J. S. Rogers, H. H. Hobbs, F. N. Young, L. Berner); Hosford, Liberty Co., March 17, 1939 (L. B.). All records from Florida.

SOME NEW SPECIES OF CANTHARIDAE AND CHRYSOMELIDAE (COLEOPTERA) *

BY W. J. BROWN,
Ottawa, Ontario

Podabrus West.

A series of specimens of this genus from Churchill, Manitoba, includes males of *piniphilus* Esch., of *heteronychus* Fall, and of two species which are described below as new. I am unable to distinguish the females, all of which have each claw of each tarsus supplied with a broad basal tooth.

Podabrus deceptus n. sp.

Male. Length 5.5 mm. Black; the head in front of the antennae and the lower surface of the three basal segments of each antenna yellow; the anterior tibiae tinged with yellow; the lustre dull throughout. Antennae slender; the seventh segment fully three times as long as wide.. Head slightly but distinctly wider than the pronotum, the latter three-fourths as long as wide. Claws of the anterior and middle tarsi finely cleft; those of the posterior tarsi each with a broad, acute tooth at base. Other characters as in *heteronychus* Fall.

Holotype—♂, Churchill, Man., July 13, 1937 (W. J. Brown); No. 4285 in the Canadian National Collection, Ottawa.

Paratypes—2 ♂, same data, June 28 and August 2, 1937.

This species seems to differ from *perplexus* n. sp. and *heteronychus* only in having the antennae a little more slender and in the form of the claws of the middle tarsi. It traces to couplet forty-eight in Fall's table (1928, Ent. Amer., VIII, 66) but differs in color and other characters from all of the species included there.

Podabrus perplexus n. sp.

Male. Antennae as in *heteronychus* Fall, not very slender, the seventh segment twice as long as wide. Claws of the anterior tarsi finely cleft; each claw of the middle and posterior tarsi with a broad, acute tooth at base. Other characters as in *heteronychus* and *deceptus* n. sp.

Holotype—♂, Churchill, Man., June 29, 1937 (W. J. Brown); No. 4286 in the Canadian National Collection, Ottawa.

Paratype—1 ♂, same data, June 22, 1937.

This species is evidently allied to *probus* Fall which is described as having the head wider and the pronotum as long as wide.

Podabrus secretus n. sp.

Male. Length 6 mm. Black, the anterior portion of the head, ventral surface of first and second antennal segments, and pronotal sides reddish-yellow; the pale areas of the pronotum occupying one-third the pronotal width in apical three-fifths and one-sixth in basal two-fifths; elytra a little paler than the black parts of head and pronotum, their external margins yellow, each with a broad, obscure, brownish-yellow vitta near the suture; underside of prothorax, posterior margins of the abdominal segments, and the front and middle trochanters yellow; the posterior trochanters bicolored; the femora and tibiae entirely black.

Posterior portion of the head alutaceous, opaque; the punctures rather fine and very close, very feebly impressed. Antennae extending to apical third of the elytra, the second segment of each two-thirds as long as the third.

Pronotum six-sevenths as wide as the head, its length equal to five-sixths of its width; its sides straight, diverging anteriorly; posterior angles prominent, the anterior obliquely truncate. Disk with areas before and between the convexities alutaceous and subopaque, elsewhere shining; the entire surface rather finely, not closely punctate, the punctures feebly impressed and rather indistinct;

*Contribution from the Division of Entomology (Systematic Entomology), Department of Agriculture, Ottawa.

the median line sharply impressed in basal three-fifths. Elytra as in *obscurevittatus* Fall.

Anterior tibiae straight, not dilated apically. Posterior coxae not modified. Claws of front and middle tarsi finely cleft, those of the posterior tarsi broadly and acutely toothed.

Female. Eyes less prominent, the head and prothorax equal in width. Antennae shorter, extending over the basal fourth of the elytra. Each tarsal claw with a broad, acute tooth.

Holotype—♂, Mt. Albert, Que., 3000 to 3200 ft., July 18, 1933 (W. J. Brown); No. 3672 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—26 ♂, 6 ♀, same data, July 18 and 20, 1933; 2 ♂, same data, 3500–3750 ft., July 21, 1933.

The paratypes measure from 5 to 7 mm. The posterior portions of the pronotal marginal bands are occasionally a trifle wider than in the type. In one specimen the bands are very narrowly interrupted near the middle by the black area of the disk. In none do they extend along the apical and basal margins of the pronotum. In some of the specimens, the pale vittae of the elytra are not evident. Occasionally the vittae are extended to cover the entire elytra except the posthumeral portions. The femora and tibiae are always dark throughout.

The species is very closely allied to *obscurevittatus* and seems to differ only by the color of the pronotum and legs. In *obscurevittatus*, the anterior and posterior margins of the pronotum are reddish-yellow, and the anterior legs are largely pale. In *puberulus* Lec., the head and pronotum show a different type of sculpture, the anterior legs are pale, the elytra lack pale lateral margins, and the pronotum is usually of a different color.

This interesting species occurred very abundantly above the tree line on Mt. Albert. It is probably restricted to such situations, as extensive collecting in the adjacent wooded parts of the Gaspé peninsula has failed to produce specimens.

Polemius canadensis n. sp.

Length of males 4 to 5 mm., of females 5 to 7 mm. Black; head with the part in front of each eye, the mandibles except at their apices, and the gular region yellow; pronotum with the sides yellowish-red, the pale areas occupying from two-fifths to three-fourths of the pronotal surface, the prothorax yellow beneath; each elytron with the epipleuron and often the humeral umbone brown or brownish-yellow; abdomen with the sides narrowly pale; first two or three antennal segments beneath, the extreme apices of the coxae, and sometimes the trochanters brown or brownish-yellow. Antennae not serrate. Secondary sexual characters as in allied species.

Holotype—♂, Tabusintac, N. B., July 25, 1939 (W. J. Brown); No. 4976 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—15 ♂, 5 ♀, same data, July 19 to 26, 1939; 4 ♂, 1 ♀, Bathurst, N. B., August 6 to 12, 1939 (W. J. Brown); 1 ♂, 1 ♀, Portaupique, N. S., July 25, 1929 (C. A. Frost).

In color, *canadensis* resembles *laticornis* Say which is a larger species with distinctly serrate antennae and an entirely black abdomen. In *laticornis* Say the pale margins of the pronotum are a little narrower than in most specimens of *canadensis*. By color only may *canadensis* be distinguished from *limbatus* Lec. In the latter, the elytra have the lateral margins, except near the apex, and the sutural margins pale, and the pronotum is largely or entirely pale. All of the New Brunswick specimens of *canadensis* were taken in salt marshes.

Silis freemani n. sp.

Male. Length 5 mm.; width 2 mm.; the body elongate as in *difficilis* Lec. and *percomis* Say. Head black, the portion before the antennae and the mouth-parts, except for the tips of the mandibles and palpi, stramineous; antennae black, with the three basal segments pale beneath; prothorax pale, bright red; the scutellum stramineous; the elytra black with the sutural and lateral margins (but not the apical) narrowly stramineous; metasternum black; abdomen blackish, the segments margined with stramineous; legs black, the trochanters, anterior and middle coxae, and the extreme bases of the tibiae pale. Eyes moderately prominent as in *difficilis* and *percomis;* antennae rather short and stout, not serrate, extending slightly beyond the middle of the elytra, the second segment half as long as the third, none of the segments more than three times as long as wide.

Pronotum as figured; the anterior margin truncate; the basal margin rounded; the lateral armature ante-basal, its anterior lobe rounded and supplied with a process which projects caudally and dorsally over the posterior lobe, the latter consisting of an anterior coriaceous portion and a posterior sclerotized portion. Pronotal disk suddenly elevated on each side near the armature, concave between the elevations, the concavity extending longitudinally from

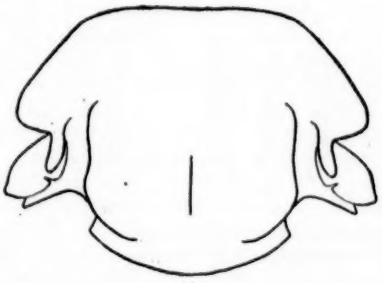


Fig. 1. Pronotum of *Silis freemani* n. sp.

base to apical fourth; the median line very narrowly impressed for a short distance near base. Elytra not as strongly roughened as in *difficilis* and *percomis.* The seventh abdominal segment divided on its median line but the two halves contiguous, concealing the eighth segment. Third tarsal segment distinctly triangular as in *latiloba* Blatch.; the fourth segment bilobed, divided to the insertion of the fifth, larger than usual, only two-fifths of the apical segment projecting beyond its apex; anterior claw of anterior tarsus with a large, rounded lobe at base, the claw abrupty bent at the apex of the lobe, its distal portion straight; all other tarsal claws simple.

Holotype—♂, Brownsville, Tex., February 22, 1937 (T. N. Freeman); No. 4217 in the Canadian National Collection, Ottawa.

The characters of the tarsi and seventh abdominal segment, as well as those of the prothorax, are worthy of special note. The species is not closely allied to any of those known from north of Mexico. It belongs in the suppressed genus *Ditemnus* Lec. and may be placed near *tricornis* Van Dyke.

Syneta Dej.

The species of this genus exhibit important characters in the vestiture of the elytra and in the genitalia of the males. In *simplex* Lec. and *pilosa* n. sp., each elytral puncture bears a distinct, semi-erect hair. In all of the

other North American species, these hairs are recumbent and are so small that each is contained entirely or almost entirely within its puncture. The hairs may be observed without difficulty in *albida* Lec.; in the other species high magnification and very good lighting are necessary for their detection. In addition to these hairs of the elytral punctures, a few longer hairs are present on the elytral costae in most, if not all, of the species.

The new species described below are allied to *carinata* Mann. and fall with that species in the keys of Horn (1892, Trans. Am. Ent. Soc., XIX, 3) and Brisley (1927, Pan-Pac. Ent., IV, 59).

Syneta carinata Mann.

Syneta carinata Mann., 1843, Bull. Soc. Mosc., XVI, 307.

Male. Length 7.5—8.8 mm. Blackish, the first three segments of each antenna in part at least, the head beneath and in front of the antennae, the basal and apical margins of the pronotum, pro- and mesosternum, coxae, trochanters, basal parts of the femora, inner sides of the tibiae, and sometimes the abdominal segments at middle dull yellow; elytra brown to dull yellow, the lateral margins paler, the suture blackish.

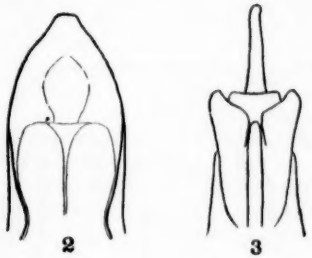


Fig. 2. Apex of aedeagus of *Syneta carinata* Mann.
Fig. 3. Apex of aedeagus of *Syneta pilosa* n. sp..

Elytra with the costae well developed; the first costa becoming feeble or obsolete behind the middle; the intervals between the costae flat or even slightly concave; hairs of the elytral punctures very minute, each contained within its puncture. Each tibia with two terminal spurs. The hind tibia slightly enlarged near apex. Aedeagus with the apical portion as figured, ligulate; the extreme apex abruptly deflexed, forming a small ventral tooth.

Female. Larger and paler than the male. Length 8—11 mm. Markings as in the male but the darker areas dull red or yellow rather than blackish; the head and thorax rarely blackish in part; the blackish areas of the legs and antennal bases less extensive.

This is the largest of our species. In color it resembles dark specimens of *pilosa*, but in the latter each elytral puncture is supplied with a distinct hair. The present species is evidently confined to the west. Sitka, Alaska, is its type locality, and it is known to me from Waterton and Crow's Nest Pass, Alberta, and from the following localities in British Columbia: Stanley, Mt. Revelstoke, Trinity Valley, vicinity of Prince Rupert, and the Forbidden Plateau of Vancouver Island.

Syneta pilosa n. sp.

Male. Length 6—7 mm. Head behind the antennae, pronotum, metasternum, and abdomen dark reddish-brown in the holotype, varying from dull red to black in the paratypes; elytra dull yellow, the suture brown or blackish, the fourth costa usually and rarely the entire elytra strongly infuscate; antennae

black, the three basal segments of each largely yellow; anterior and ventral parts of the head, the pro- and mesosternum, and the legs yellow; the legs with the tarsi, the outer sides of the tibiae, and the subapical parts of the femora brown or blackish.

Elytra often with the costae well developed as in *carinata*, often with the first distinct only at base and the third rather feeble; the intervals between the costae flat or slightly concave; each puncture with a distinct, semi-erect hair. Each tibia with two terminal spurs; the hind tibiae gradually widened to apex as in the female. Aedeagus with the apical portion as figured, subtruncate and lobed, the ventral lobe produced into a long, slender process.

Female. Larger and paler than the male. Length 7–8.2 mm. Head behind the antennae and pronotum usually dull red, sometimes reddish-brown; metasternum and abdomen reddish-yellow; legs usually entirely yellow, sometimes with the tarsi and subapical portion of each femur darker; fourth elytral costa and suture not or feebly infuscate; the antennae black or reddish-brown, pale at base.

Holotype– ♂, Mt. Lyall, Gaspé Co., Que., 1500 ft., July 14, 1933 (W. J. Brown); No. 4420 in the Canadian National Collection, Ottawa.

Allotype– ♀, same data, July 4, 1933.

Paratypes–3 ♂, 5 ♀, same locality, July 4 to August 25, 1933 (W. J. Brown and E. B. Watson); 1 ♂, Bathurst, N. B., May 31, 1923 (H. S. Fleming); 1 ♂, 3 ♀, Tabusintac, N. B., June 17 and 20, 1939 (W. J. Brown); 1 ♀, Laniel, Que., July 20, 1930 (H. S. Fleming); 1 ♂, Rivière au Doré, Que., 1938; 2 ♂, Notre Dame de la Doré, Lake St. John District, Que., June, 1938; 3 ♂, Duparquet, Que., June 12, 1936, and June 3 and 7, 1939 (G. Stace Smith); 1 ♂, Little Current River, Ont., July 1–20, 1903 (W. J. Wilson); 1 ♂, Crow's Nest Pass, Alta., June 9, 1930 (J. H. Pepper); 1 ♂, Sunwapta River, Jasper District, Alta., June, 1938; 1 ♂, Clearwater River, Alta., August, 1938; 2 ♂, Mile 45, Jasper-Lake Louise Highway, Alta., June 16, 1938 (E. McDonald); 6 ♂, 10 ♀, Stanley, B. C., June 8 to August 7, 1928 and 1929 (W. G. Mathers); 1 ♂, Paul Lake (near Kamloops), B. C., May 24, 1933 (A. Thrupp); 2 ♂, Lorna, B. C., June 10 and 17, 1925 (K. Auden and H. Richmond); 2 ♂, 1 ♀, Revelstoke Mt., B. C., August 3 and 12, 1922 and 1923 (A. C. Thrupp and P. N. Vroom), and July, 1938; 1 ♀, Fish Lake, Summerland, B. C., June 24, 1931 (A. N. Gartrell); 1 ♀, Trinity Valley, B. C., May 17, 1933; 2 ♂, Copper Mountain, B. C., May 30, 1929 and June 30, 1930 (G. Stace Smith); 1 ♀, Creston, B. C., June 6, 1937 (G. Stace Smith).

This species differs from all others except *simplex* in having each elytral puncture supplied with a moderately long hair. In *simplex*, all elytral costae except the fourth are obsolete, the elytra are evenly convex, and each front and hind tibia is supplied with a single spur. The present species is more closely allied to *ferruginea* Germ. and *carinata* Mann. with which it is confused in collections. It is possibly this species that Schaeffer discussed as a small form of *carinata* (1933, Jour. N. Y. Ent. Soc., XLI, 298).

Syneta extorris n. sp.

Male. Length 5.2–5.8 mm. Blackish or very dark brown, the basal segments of the antennae and the anterior portion of the head a little paler; only the trochanters and adjacent parts of the coxae yellow.

Elytra with the costae distinct but rather feeble, the elytra therefore more evenly convex than in *carinata;* the first costa not becoming obsolete at middle, distinct to the apical declivity; the hairs of the elytral punctures minute, each contained within its puncture. Each tibia with two terminal spurs, the hind tibia slightly curved near apex. Aedeagus as in *carinata.*

Female. Much paler and larger than the male. Length 6.7–7 mm. Head, prothorax, ventral surface, and legs dull red or pale reddish-brown; the head sometimes blackish at base; the anterior and posterior pronotal margins and legs in part paler; antennae blackish, the basal segments pale; elytra dull yellow. First and third elytral costae obsolete, the second less distinct than in the male. Hind tibiae straight.

Holotype—♂, Clingmans Dome, boundary of North Carolina and Tennessee, 6600 ft., May 28, 1936 (O. L. Cartwright); No. 4419 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—2 ♂, 2 ♀, same data.

The male may be recognized by its color. The female resembles *ferruginea* closely; in the latter the legs are uniformly yellow, rather than darker in part, and except rarely, the antennae are reddish throughout. In the male of *carinata,* the posterior male tibia is enlarged on the inner side just before the apex, the outer tibial margin remaining straight. In *extorris* the tibia is similar except that the outer margin is slightly curved, causing the tibia to appear slightly bent, rather than simply enlarged, near the apex.

Calligrapha knabi n. sp.

Length of holotype 7.1 mm., of paratypes 6.3 to 8 mm. Body short and robust as in *rowena* Knab. Head, thorax, and abdomen very dark green; elytra whitish with very dark blue-green spots; legs, antennae, palpi, and labrum pale reddish-brown. Elytral pattern of the type found in *scalaris* Lec. and its allies; each elytron with a sutural stripe on the first and second intervals to which is joined an arcuate band on the middle third and a spot near the apex, the posterior portion of the arcuate band and the subapical spot not attached to the median stripe in several of the paratypes; the spot partly enclosed by the humeral lunule large, usually circular in form, sometimes with a shallow anterior emargination but never divided, frequently joined to the lunule; elytral disk with a sublateral spot at middle and from seven to fourteen small, irregular spots, dark areas of the elytra convex, the punctures of the disk rather coarse and close as in *rhoda* Knab. Tarsal claws rather strongly divergent as in *scalaris.*

Food plant: *Cornus* sp. (probably *C. stolonifera* Michx.)

Holotype—Cascapedia, Que., June 13, 1933 (W. J. Brown); No. 4411 in the Canadian National Collection, Ottawa.

Paratypes—19, same data, June 8 to 13, 1933.

This species is closely allied to the others of the *scalaris* group. In *scalaris* the body is larger and the elytral spots are not convex. In *rhoda* the tarsal claws are less strongly divergent, and the spot enclosed by each humeral lunule is smaller and is usually divided into two spots. The present species resembles *confluens* Schffr. more closely. In that species, the body is slightly more elongate, the spot enclosed by the humeral lunule is smaller, and the sutural interval is nearly always pale in part posteriorly. In *knabi* this interval is entirely dark. The oblique, posterior portion of the humeral lunule is elongate in *confluens;* in *knabi* it is short as in *rowena* or entirely lacking except in two of the paratypes that resemble *confluens* in this respect. In *confluens* the dark sutural stripe is deeply divided on each side of the scutellum by a pale intrusion; two paratypes of *knabi* are similar, but in the others the sutural stripe lacks the intrusion as does *rowena. C. rowena,* like *knabi,* feeds on dogwood. In *rowena* the small spots of the elytra are nearly always smaller and less numerous than in *knabi,* and the elytra of all specimens at hand, which were collected in the spring or early summer, show strong red suffusions that are entirely lacking in *knabi.*

A NEW SPECIES OF INCISALIA FROM SOUTHERN CALIFORNIA (RHOPALOCERA, LYCAENIDAE)*

BY CYRIL F. DOS PASSOS,

Mendham, New Jersey

The opening of a new highway along the coast from Monterey to San Luis Obispo, California, made it possible to collect in a hitherto rather inaccessible region. In 1938 Dr. Michael Doudoroff of the Hopkins Marine Station, Pacific Grove, California, took near Monterey, a few badly worn specimens of an *Incisalia* which he believed to be new. Returning the ensuing year in June and following the highway south about thirty miles below Carmel, he stopped near Big Sur, Monterey County, and there, after rather strenuous collecting on the precipitous seaward slopes of the mountains, he succeeded in taking a small series (eleven males and two females) of these butterflies. These he very kindly sent to me for determination.

The only species of the genus *Incisalia* thus far recorded from California, according to Dr. John A. Comstock (1927, Butterflies of California, p. 167), are *eryphon* Boisduval (1852, Ann. Soc. Ent. France, (2), X, p. 290) and *iroides* Boisduval (1852, Ann. Soc. Ent. France, (2), X, p. 289), but both are totally different from Dr. Doudoroff's specimens.† The nearest relatives to his specimens appear to be *mossii* Hy. Edwards (1881, Papilio, I, p. 54), described from Esquimalt, Vancouver Island, British Columbia, and *schryveri* Cross (1937, Proc. Colorado Mus. Nat. Hist., XVI, p. 16), described from Chimney Gulch, Colorado. In the absence of connecting records of capture and especially in view of the different color of the upper side and of the structure of the genitalia, it would seem that Dr. Doudoroff's discovery presents a new species. While but few slides have been made of the genitalia of *mossii, schryveri* and this new species, the entire structure of that of the new species, except the oedeagus, is longer and more tenuous. The outer lobes of the tegumen (labides) are more rounded in the new species than in *mossii* and *schryveri* where these structures are more angular. Also the lobes of the new species are somewhat excavated at the outer part near the bottom while those of the other two species are excavated at the center. General comparison has been made with one male paratype and three topotypes of *schryveri;* and with specimens of *mossii* as follows: one male and one female from Tzouhalem, Vancouver Island, B. C., April 22, 1922 (G. O. Day) (male genitalia slide No. 148, C. F. dos Passos); one male from Victoria, B. C. (A. J. Croker); and several specimens from Victoria, B. C., kindly loaned to me by Mr. William P. Comstock. My attention has also been called to a single *schryveri* female in Mr. Comstock's collection labeled "Stockton, Utah, V. 23. '04, Tom Spalding." From an examination of these specimens, it would seem that the new species is closer to *mossii* than to *schryveri.*

The new species is easily separated by its color on the upper side from *mossii,* the former being fuscous to chaetura drab‡ whereas the latter was termed "bright chestnut brown" by Hy. Edwards (*loc. cit.*, p. 54), although that color would seem to apply only to the female.§ Both sexes of *mossii* would appear better described as saccardo's umber for the male and antique brown for the female. On the underside the most noticeable difference is the greater contrast in *mossii* between the basal and limbal areas which are separated by a distinct

*Contribution from the Department of Entomology, American Museum of Natural History.

†The Gunder collection at the American Museum of Natural History contains a series of fourteen males and nine females of *Incisalia fotis* Strecker (1877, Lepidoptera, Rhopaloceres and Heteroceres, p. 129) from Bonanza King Mine, Providence Mountains, San Bernardino Co., California, taken in the latter part of March and the early part of April 1934.

‡All color terms refer to Robert Ridgway, 1912, Color Standards and Color Nomenclature.

§An examination of Henry Edwards' type of *mossii* at the American Museum of Natural History reveals that it is in fact a female and not a male as described.

white line, and the lesser contrast in the new species with an indistinct white line. The markings are otherwise very similar.

I am pleased to name this new species in honor of Dr. Doudoroff.

Incisalia doudoroffi new species

Male. Length of primary 11 mm. to 14.5 mm. (holotype, 14 mm.). Upperside of both wings is fuscous to chaetura drab, darker at outer margin, with a few sayal brown scales at anal angle (on three of the males there is a sayal brown patch), the border black with a white fringe, somewhat cut by the black veins on the secondaries. The ablong stigma is usually indistinct. The underside is generally similar to *mossii*, but the irregular line on the primaries which separates the basal and the limbal areas is less distinctly edged with white and both areas are paler; the outer margin is darker than the limbal area. The basal area of the secondaries is auburn, edged with a black line faintly margined outwardly with white, the limbal area is paler with eight or nine small black dots between the veins, and beyond there is an auburn shading in the margin less pronounced than in *mossii*. Fringes of both wings are white with some brownish scales. Head, body and legs concolorous with basal area of wings.

Female. Length of primary 14 mm. Upper side of both wings is tawny olive, much darker at the base, along the costal margin and at the apex; the outer margin black, the fringes black and white. Underside is similar to the male but paler and with less contrast between the basal and limbal areas, the former having a blotchy appearance on the secondaries with some hoary scales, the marginal line edged inwardly with white, outwardly with brown and with scattered white scales.

The types and their disposition are as follows: *Holotype*, Male, Big Sur, Monterey County, California, June 9, 1939 (Dr. Michael Doudoroff); *allotype*, female, same locality, date and collector; both in the American Museum of Natural History. *Paratypes*, same locality and collector, six males, June 6, 1939; four males and one female, June 9, 1939. One male paratype each to the British Museum (Natural History), Canadian National Collection, United States National Museum, Los Angeles Museum, Carnegie Museum, and the Academy of Natural Sciences of Philadelphia. The remainder are in the collections of Dr. Doudoroff and the author.

RESEARCH NOTE

THE TRANSFORMATION OF DATA FROM ENTOMOLOGICAL FIELD EXPERIMENTS

It has been suggested by Dr. M. S. Bartlett* that if x is the number of insects found in an entomological experiment on a given plot, then the analysis of variance ought to be made on the quantities, $x^{1/2}$, which should better satisfy the assumptions underlying the analysis than the former quantities. This transformation is based on the assumption that the insects are distributed randomly. In fact, there is usually some disturbance from true randomness and under these conditions the writer finds that the transformation to $k^{-1/2} \sinh^{-1} (kx)^{1/2}$, where k is a constant peculiar to a given experiment, will probably be more appropriate. The magnitude of k may be estimated from the relationship between the mean and standard deviation of numbers of insects on plots within a given block and subjected to a given treatment. The writer purposes shortly to publish applications of the transformation suggested and a table of transformation.

Geoffrey Beall,
Dominion Entomological Laboratory, Chatham, Ontario.

*Bartlett, M. S., 1936. Square root tranformation in analysis of variance. Jl. Roy. Stat. Soc. Supp. (Ind. & Agr. Section), 3: 68-78.

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